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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,044	09/28/2001	Douglas T. Grider	TI-31118	4815

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EXAMINER	
MALDONADO, JULIO J	
ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 05/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/967,044	GRIDER, DOUGLAS T.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 March 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsunoda (U.S. 5,698,464) in view of Kraft et al. (U.S. 6,136,654).

Tsunoda (Figs.1-6) in a related method to form an oxynitride layer teaches the steps of providing a semiconductor substrate (1); forming an oxide layer (12) on the semiconductor substrate (1); incorporating nitrogen into the oxide layer (12) thereby converting the oxide layer (12) to an oxynitride layer (14); and annealing said oxynitride layer (14) in N_2O to form an oxynitride layer with a uniform nitrogen concentration profile, wherein said annealing comprises rapid thermal annealing at a temperature of 700°C – 1,100°C for 10 – 60 seconds (column 2, line 55 – column 4, line 10).

Tsunoda fails to teach incorporating nitrogen by exposing the oxide layer to a high-density nitrogen plasma. However, Kraft et al. (Figs.1-2) in a related method to form a gate oxynitride structure teach the steps of forming a gate oxide layer (14) and exposing the oxide layer to a high-density nitrogen plasma (column 3, line 58 – column 5, line 60). Therefore, it would have been obvious to one of ordinary skill in the art at the of the invention was made to form the silicon oxynitride layer as taught by Kraft in

the method of Tsunoda, since this would result in a dielectric layer substantially free of contaminants (e.g. hydrogen) (column 2, lines 44-45).

Still, Tsunoda in combination with Kraft et al. fail to teach applying the high-density plasma at a power level of 700 – 900 watts. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

3. Claims 4 and 8 –10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin et al. (U.S. 5,972,804) in view of Tsunoda ('464).

Tobin et al. (Figs.13-18) in a related method to form a field effect transistor structure teach the steps of providing a semiconductor substrate (13); forming a gate dielectric layer (23) on the semiconductor substrate (13); forming a conductive layer (43) on said gate dielectric layer (23); forming sidewall structures (54) adjacent to said

conductive layer (23); and forming source and drain regions (56) in the semiconductor substrate (13) adjacent to said sidewall (54) structures (column 12, line 36 – column 14, line 6).

Tobin et al. fail to teach wherein the gate dielectric layer has a uniform nitrogen concentration. However, Tsunoda (Figs.1-6) in a related method to form a dielectric layer teach providing a substrate (11); and forming a dielectric layer (12) over the substrate (11), wherein the gate dielectric layer (12) has a uniform nitrogen concentration (column 2, line 55 – column 4, line 10). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form the oxide layer as taught by Tsunoda in the method of Tobin et al., since this would reduce the leakage of the formed gate oxide (column 1, lines 32 – 60).

In reference to claims 8 – 10, Tobin et al. in combination with Tsunoda substantially teach all aspects of the invention but fail to show that said uniform nitrogen concentration is greater than 6 atomic percent; the gate dielectric layer having a thickness of less than 40 Angstroms thick; and said uniform nitrogen concentration describes a nitrogen concentration with less than 10% variation across the gate dielectric layer. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held

that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

4. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin et al. ('804) in view of Tsunoda ('464) as applied to claims 4 above, and further in view of Kraft et al. ('654).

Tobin et al. in combination with Tsunoda teach forming an oxide layer (12) on the semiconductor substrate (1); incorporating nitrogen into the oxide layer (12) thereby converting the oxide layer (12) to an oxynitride layer (14); and annealing said oxynitride layer (14) in N_2O to form an oxynitride layer with a uniform nitrogen concentration profile, wherein said annealing comprises rapid thermal annealing at a temperature of 700°C – 1,100°C for 10 – 60 seconds (column 2, line 55 – column 4, line 10).

Tobin et al. in combination with Tsunoda fail to teach incorporating nitrogen by exposing the oxide layer to a high-density nitrogen plasma. However, Kraft et al. (Figs.1-2) in a related method to form a gate oxynitride structure teach the steps of forming a gate oxide layer (14) and exposing the oxide layer to a high-density nitrogen plasma (column 3, line 58 – column 5, line 60). Therefore, it would have been obvious to one of ordinary skill in the art at the of the invention was made to form the silicon oxynitride layer as taught by Kraft in the method of Tsunoda, since this would result in a

dielectric layer substantially free of contaminants (e.g. hydrogen) (column 2, lines 44-45).

Still, Tobin in combination with Tsunoda and Kraft et al. fail to teach applying the high-density plasma at a power level of 700 – 900 watts. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Response to Arguments

5. Applicant's arguments filed 03/17/2003 have been fully considered but they are not persuasive.

Applicant argues, "...the Tsunoda patent does not teach forming a film with uniform concentration as stated and relied upon by the examiner. The scale shown in Fig.6 is qualitative and therefore meaningless as a measure of absolute nitrogen

concentration...". In response to this argument, Fig.6 teach a concentration profile of the nitrogen concentration through line A1-A2, from point B1 to point B2, as illustrated in Fig.4. According to Fig.6, by following the procedure as described by Tsunoda, the nitrogen concentration in the dielectric layer is 4 atom percent (column 3, lines 6 – 16). Also, as shown in Fig.6, the nitrogen concentration is 4 atomic percent along the dielectric layer, therefore uniform as taught if Fig.3e of the claimed invention. Therefore, the examiner submits that Tsunoda does teach that the dielectric layer has a uniform concentration and that Fig.6 is not "meaningless" as agued by the applicant.

Furthermore, applicants argue that there's no disclosure to eliminate the X-ray step in Tsunoda. However, the claims are operable to the step though the use of the open "comprising" language.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

JMR
5/13/03

George Fourson
Primary Examiner